

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 9440WO/PT/LA	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE 2003/001970	International filing date (day/month/year) 16-12-2003	Priority date (day/month/year) 17-12-2002
International Patent Classification (IPC) or national classification and IPC H01G 4/232, H01G 13/00		
Applicant ABB Technology Ltd et al		

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>5</u> sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>	
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>	

Date of submission of the demand 30-06-2004	Date of completion of this report 23-02-2005
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 2003/001970

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 9 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 10 - 14 received by this Authority on 12 November 2004
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1/4 - 4/4 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 003/001970

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-27</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-27</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-27</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The documents cited in the International Search Report are indicated to be relevant to claim 28 alone. Anyhow, claim 28 has been deleted from the set of claims, in order to constitute the amended claims.

The prior art cited in the International Search Report is not indicated in that Report to be relevant to the amended claims. This prior art does not disclose the invention defined in the claims, nor does it give any indication that would lead a person skilled in the art to the claimed method or equipment for manufacturing a power capacitor. Accordingly, the invention defined in claims 1-27 is novel and is considered to involve an inventive step. The invention is industrially applicable.

CLAIMS

1. A method for manufacturing a power capacitor comprising at least one capacitor element (1), wherein the capacitor element (1) comprises a roll of alternate dielectric films (4) and electrode films (2, 3), wherein the roll has first and second end surfaces (5, 6), facing away from each other, in which said electrode films (2, 3) are connectably exposed, characterized in that a solder tip (21) is preheated in a pot (20) with a preheated solder, that the solder tip is then coated with solder, whereupon at least one of the end surfaces (5, 6) of the capacitor element is coated with at least one solder by bringing the solder tip (21) into contact with said end surface (5, 6), that the contact is brought to cease, and that at least one lead (7, 9) is fixed by soldering to said end surface (5, 6).
2. A method according to claim 1, characterized in that the capacitor element (1) is wound from the electrode films, comprising a first aluminium foil (2) and a second aluminum foil (3), with at least one intermediate dielectric film (4) of a polymer material, wherein the first aluminium foil (2) at the first end surface (5) of the capacitor element is arranged so as to project outside the edge of the polymer film (4), whereas at the same first end surface of the edge of the capacitor element the edge of the second aluminium foil (3) is arranged with its edge inside the edge of the polymer film (4) so that the end (5) of the capacitor element exhibits the shape of a roll of the first aluminium foil (2) only and the second aluminium foil (3) is arranged so that the second end (6) of the capacitor element in a corresponding way exhibits the shape of a roll of the second aluminium foil (3) only, that the solder tip comprises an active tip (26) which is coated with the solder, and that the solder tip (21), after having been brought into contact with the end surface (5, 6) of the capacitor element, is moved along the end surface (5, 6) of the capacitor element.

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3. A method according to claim 2, characterized in that the movement is carried out in one sequence comprising a starting point (P1), two turning points (P2, P3) between which the solder tip (21) is moved in one or more cycles, and one end point (P4) from which the solder tip (21) is removed from the end surface (5, 6) of the capacitor element, whereby the first or the second turning point (P2, P3) may be the same as the starting point (P1) or the end point (P4).
4. A method according to any of claim 2 or 3, characterized in that the speed of movement of the solder tip along the end (5, 6) of the capacitor element is between 0 m/s and 0.1 m/s.
5. A method according to any of the preceding claims, characterized in that the solder tip (21) when first being brought into contact with the end (5, 6) of the capacitor element presses down the end surface (5, 6) of the capacitor element.
6. A method according to claim 5, characterized in that the solder tip (21) is pressed down to a depth of between 0 and 6 mm in the end surface (5, 6) of the capacitor element.
7. A method according to claim 6, characterized in that the solder tip (21) is arranged on a shaft (22), whereby the shaft is journaled in a bearing housing (23) which permits relative axial movement, wherein the depth into which the solder tip (21) is pressed down is determined by the total weight of the solder tip (21) and the shaft (22) and by the friction in the bearing housing (23).
8. A method according to claim 6, characterized in that the solder tip (21) is arranged on a shaft (22), whereby the shaft is journaled in a bearing housing (23) that permits relative axial movement, and that the shaft (21) is provided with a compression spring (27), whereby the depth into which the solder tip (21) is pressed down is determined by the total weight of the solder tip (21), the shaft (22) and the

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compression spring (27), the friction in the bearing housing (23) plus the compression of the compression spring (27).

9. A method according to any of the preceding claims,
5 characterized in that the solder tip (21) is arranged on a shaft (22), whereby the solder tip (21) during the pre-soldering is brought to rotate in the direction of rotation of the shaft (22).
- 10 10. A method according to claim 9, characterized in that the solder tip (21) is brought to rotate in one or the other direction of rotation, or that the rotation is reversing.
- 15 11. A method according to claim 10, characterized in that the rotation is less than one complete turn, that is, is less than 360°.
- 20 12. A method according to any of the preceding claims, characterized in that the temperature of the solder in the solder pot is in the interval of between 300 °C and 400 °C.
13. A method according to any of the preceding claims, characterized in that the solder contains tin and zinc.
- 25 14. A method according to claim 13, characterized in that the solder contains 75% tin and 25% zinc.
- 30 15. Equipment (10) for carrying out the method according to any of claims 1-14, characterized in that it comprises a solder pot (20), a solder head (12), whereby the solder head is arranged with a first linear module (13) for movements in the x-direction (horizontally) and a second linear module (14) for movements in the y-direction (vertically), and a press unit (15) for fixing the capacitor elements (1), wherein the
35 solder pot (20), the solder head (12), the first and second (13, 14) linear modules and the press unit (15) are arranged on a steel frame (11).

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16. Equipment according to claim 15, characterized in that the solder head (12) is arranged with a solder tip (21) provided with an active tip (26), said solder tip being arranged on a shaft (22) and a turning device (25), whereby the shaft (22) is connected to the turning device (25) with an insulating shaft (24) and whereby the shaft (22) is journaled in a bearing housing (23).
17. Equipment according to claim 16, characterized in that the shaft (22) and the insulating shaft (24) are arranged so that a guide pin prevents relative axial movement.
18. Equipment according to claim 16, characterized in that the shaft (22) and the insulating shaft (24) are arranged so that a guide pin, running in an axial slit, makes possible a relative axial movement.
19. Equipment according to claim 18, characterized in that a compression spring (27) is arranged between the shaft (22) and the turning device (25), whereby the compression spring (27) counteracts the shaft (22) being moved in a direction towards the turning device (25).
20. Equipment according to any of claims 16-19, characterized in that the turning device (25) is arranged so that a rotating movement is transmitted to the solder tip (21).
21. Equipment according to any of claims 16-20, characterized in that the active tip (26) is arranged with a rotationally symmetrical cross section.
22. Equipment according to claim 21, characterized in that the active tip (26) is arranged with a smooth end surface.
23. Equipment according to claim 21, characterized in that the active tip (26) is arranged with an end surface with turned circular recesses.

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24. Equipment according to claim 21, characterized in that the active tip (26) is arranged with recesses so as to form a grid-like pattern on the end surface.
- 5 25. Equipment according to claim 21, characterized in that the active tip (26) is arranged with a cupped end surface.
26. Equipment according to any of claims 16-20, characterized in that the active tip (26) is arranged with a rectangular
10 cross section.
27. Equipment according to any of claims 15-26, characterized in that the equipment (10) is provided with a Programmable Logic Controller (PLC) and a control panel for controlling
15 the solder pot (20), the solder head (12), the first and second linear modules (13, 14), and the press unit (15).
28. A power capacitor manufactured according to the method of any of claims 1-14, characterized in that the capacitor
20 element (1) is wound from electrode film, comprising a first aluminium foil (2) and a second aluminium foil (3), with at least one intermediate dielectric film (4) of a polymer material, wherein the first aluminium foil (2) at the first end surface (5) of the capacitor element is arranged so as to
25 project outside the edge of the polymer film (4), whereas at the same end surface of the capacitor element, the edge of the second aluminium foil (3) is arranged with its edge inside the edge of the polymer film (4) so that the end (5) of the capacitor element exhibits the shape of a roll of the
30 first aluminium foil (2) only, and the second aluminium foil (3) is arranged so that the second end (6) of the capacitor element in a corresponding way exhibits the shape of a roll of the second aluminium foil (3) only, whereby the first end (5) of the capacitor element is provided with one or more
35 leads (7) connected to the first aluminium foil (2) by means of one or more solders (8) and that the second end (6) of the capacitor element in a corresponding way is arranged with one or more leads (9) connected by one or more solders to the second aluminium foil (3).

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